

## **Section 2. American Eels**

The American eel (*Anguilla rostrata*) has a unique life history that presents many challenges in its management. All American eel on the Atlantic coast come from a single spawning population in the Sargasso Sea. As larvae and elvers (young eels 2” – 5” in length) they travel on ocean currents along the coast. While they migrate they continue to grow, swimming upstream into tributaries along the Atlantic coast from Greenland to Venezuela. They reside in these freshwater and brackish tributaries for 7 to 25 years, until they reach maturity. When mature, they emigrate from these habitats during late summer and fall and return to the Sargasso Sea to spawn and then die.

Historic abundance is difficult to estimate, but evidence suggests that abundance has decreased significantly since the 1970s. Harvest from the Atlantic coast of the United States was recorded in the mid-1970s at 3.6 million pounds and have recently declined to 898,459 lbs. (2001). Harvest data is often an unreliable indicator of stock abundance because harvest is dependent on market demand. Harvesting is especially detrimental to the eel population because of the following factors: 1) American eel mature slowly, spending up to 25 years in a tributary; 2) eel aggregate seasonally to migrate; 3) eel harvest in Bay tributaries is a cumulative stress over multiple years on the same year class; and 4) all eel fishing mortality is on pre-spawn adults. Habitat loss due to stream/river blockages has also contributed to reductions in American eel. Some estimates of upstream habitat blockage are up to 84% for diadromous fish along the Atlantic coast.

### **Chesapeake Bay FMP**

In response to declines in American eel harvest and uncertainty about stock status due to a lack of abundance data, the Chesapeake Bay (CB) American Eel Fishery Management Plan (FMP) was adopted in 1991. The goal of the CB FMP is “to manage the American eel population in the Chesapeake Bay and its tributaries so that harvest does not exceed the natural capacity of the population to maintain its size from year to year.” There is a minimum size limit of 6” in Maryland, Virginia, and on the Potomac River that protects elvers. There is a minimum mesh size for eel pots and Maryland commercial fishermen are required to report American eels used for crab bait. A synopsis of the management strategies and actions can be found in Table 2.1.

In 1999, the development of an amendment to the CB FMP with a new goal and revised objectives was proposed. However, the amendment was not completed because of other fishery management commitments and a lack of staff. Concurrently, ASMFC was adopting a coastal American eel FMP and the Chesapeake Bay jurisdictions focused on the coastal process.

### **Atlantic Coast FMP**

Since the status of the American eel stock is poorly understood and there was evidence the stock was declining, the Atlantic Marine Fisheries Commission (ASMFC)

adopted an American Eel FMP in 1999. The purpose of the coastal FMP is to reverse any local or regional declines in abundance and institute consistent fishery-independent and dependent monitoring programs throughout the management area. Fishery-independent monitoring guidelines required all states to implement a young-of-the-year (YOY) monitoring project beginning in 2001. Minimum criteria include one sampling site that must be monitored four times a week for a six-week period. YOY surveys have been completed in Maryland since 1998 (see results under stock status). Each jurisdiction is required to complete an annual compliance report (Appendix 2).

Fisheries-dependent monitoring is also required under the ASMFC guidelines. Specifically, states must report pounds landed, harvest method, gear, season, effort and life stage. ASMFC also mandates that all jurisdictions establish a minimum recreational size limit of 6 inches and a recreational possession limit of no more than 50 eels per person. Current state regulations must be maintained or improved upon. Maryland has met or exceeded the requirements of the ASMFC FMP every year.

Many research needs were addressed in the ASMFC FMP and continue to be of concern. The 2004 ASMFC FMP review delineated twenty-two areas of research. A workshop on aging and sexing techniques was held to address one of the many issues needing attention. In 2005, a peer reviewed coastal stock assessment will be completed. These results will guide future management and help refine research and data needs.

The ASMFC American Eel Management Board reviewed advice recommending management changes that address population declines described in the research results. The ASMFC American Eel Plan Development Team developed a Public Information Document (PID) on the status of American eels, current management, and potential changes to the coastal FMP. The document was open for public comment during May 2005. Based on public input and the Technical Committee recommendations, the Board may decide to make changes to the coastal FMP through the creation of an addendum or an amendment.

## **Stock Status**

Not much is known about historic abundance of American eel in the Chesapeake Bay and its tributaries or along the Atlantic coast. Harvest data cannot be used for estimates, as the fishery is market driven and fluctuates year to year. Because of lack of effort data, it is difficult to make correlations between population abundance and landings data.

Maryland has been conducting population surveys of American eel since 1998 in Chesapeake Bay tributaries and coastal Maryland locations. The 2003 data indicates an improvement over the 5-year sampling period. In 2003, the proportion of eels on the Chester River over 40cm was 72.0%, compared to 11.4% in 1998 and 1999 combined (Whiteford and Hammond 2003). The 40cm length is often viewed as a threshold because after 40cm most eels are mature and emigrate to the Sargasso Sea to spawn. In the rivers where commercial catches were sampled, the length distribution shifted to larger eels.

Results from the 2001 report show that eels greater than 40cm are younger than eels the same size along the Atlantic coast. These results suggest that Nanticoke eels mature and emigrate earlier than other coastal eels. Watermen are especially concerned since a shorter maturation time could influence the amount of time eels in the Bay are available to the fishery. This pattern would ultimately lead to decreased landings. Little is known on how environmental factors, such as salinity, affect growth rates. Environmental factors could be of greater influence on abundance than currently considered.

While little is known about historic relative abundance and levels of fishing pressure on eels, there are stock assessments underway for coast-wide stocks. ASMFC is conducting an Atlantic coast stock assessment in 2005, and regional assessments of stock status occur annually. In the Chesapeake Bay, fishing mortality (F) has been estimated at 0.35 or 43% for the Nanticoke and Chester River American eels combined (2002-2003). Nanticoke data suggests that the spawning stock biomass (SSB) needed to sustain the current levels of stock remained in the system. The yield per recruit (YPR) was 91.6% of the maximum yield. Data from the Chester River reveals that recruitment overfishing may be happening in that system, and to maintain current abundances F should be reduced to 25% (0.29). The calculations used to determine SSB and maximum spawning potential are based on maturity assumptions and calculations are preliminary estimates. These estimates are probably conservative, as younger spawning stock leads to lower spawning productivity. Eels found in freshwater were not sampled so their contribution was left out of stock estimates. In general, there is a scarcity of larger eels in some areas compared to the 1980s (Whiteford and Hammond 2003).

The young-of-the-year (YOY) survey has been conducted since 2000. Originally, sites were sampled throughout the Maryland Chesapeake Bay tributaries. These sites may not provide a true index of abundance because eels sampled were too large to be YOY (Weeder and Uphoff 2001). At the same time, elvers were sampled in Maryland's coastal bay tributaries and traps captured almost exclusively YOY. Consequently, YOY sampling only occurs in the tributaries of Maryland's coastal bays. Results of the YOY survey for 2003 indicate that recruitment to estuarine areas has been relatively stable since 2000. In 2002 there was a significantly lower catch-per-unit-effort (CPUE) than the other years. Biologists attribute this to missing the peak migration of eels that year because of increased water temperature during the sampling period. The 2004 data is not available yet.

Another aspect of American eel abundance is habitat availability. American eels are ubiquitous in Chesapeake Bay. They can be found in freshwater streams and in brackish rivers. Their contribution to stream ecosystems was historically significant, consisting of more than 25% of fish biomass. With the construction of dams and other barriers throughout many watersheds, habitat availability has been limited. Data from Maryland's Biological Stream Survey suggests a conservative estimate of 11 million fewer eels in the Susquehanna basin today than in the 1920s (MBSS unpublished data). Fish passage efforts in Maryland have been considerable, but American eels along the coast may be prevented from accessing 84% of previous upstream habitat (ASMFC 2000).

## **Fishery Statistics**

American eels have been economically and socially important throughout the history of the United States. Native American records show that harvests could provide food for the tribe for an entire year. Harvesting eels was socially important because the skills and traditions were passed along through many generations. When European settlers arrived in North America, they also harvested eels as food. As eels declined in Europe and Asia during the 1960s, eels from the Atlantic coast were harvested to fill the demand overseas.

Commercial harvest of eels has been largely market driven. The U.S. landings peaked in the 1970s at 3.6 million pounds and have declined since. In 2001, only 898,459 lbs. were harvested and marked a record low (Fig. 2.1). Most of the eels harvested in the United States are still exported to Europe and Japan. To further fill the hole created by the collapse of eels in Asia, many eels were harvested and exported to Asia for aquaculture. Some larger eels are still harvested for the aquaculture industry. The harvest of eels for use as bait in other fisheries is growing, and may soon overshadow harvest for food. Commercial fishermen use eels as bait for crabs and recreational fishermen use them as bait for sport fish such as striped bass.

In the Chesapeake Bay, fishermen primarily use eel pots for harvesting eels. In 1973, Virginia began requiring catch reports and in 1981, Maryland required licenses for the eel fishery. Catch reports were not required in Maryland until 1990 and in 1991 the Chesapeake Bay Management Plan was adopted, requiring  $\frac{1}{2} \times \frac{1}{2}$  mesh size for pots and release of eels under six inches. Estimates of commercial landings before reporting requirements were based on interviews with fishhouse managers starting in 1929. Of the coastal landings in 2002, 41% was from Maryland and Virginia combined. There is no recreational fishery for American eels, although eels caught incidentally are used as bait.

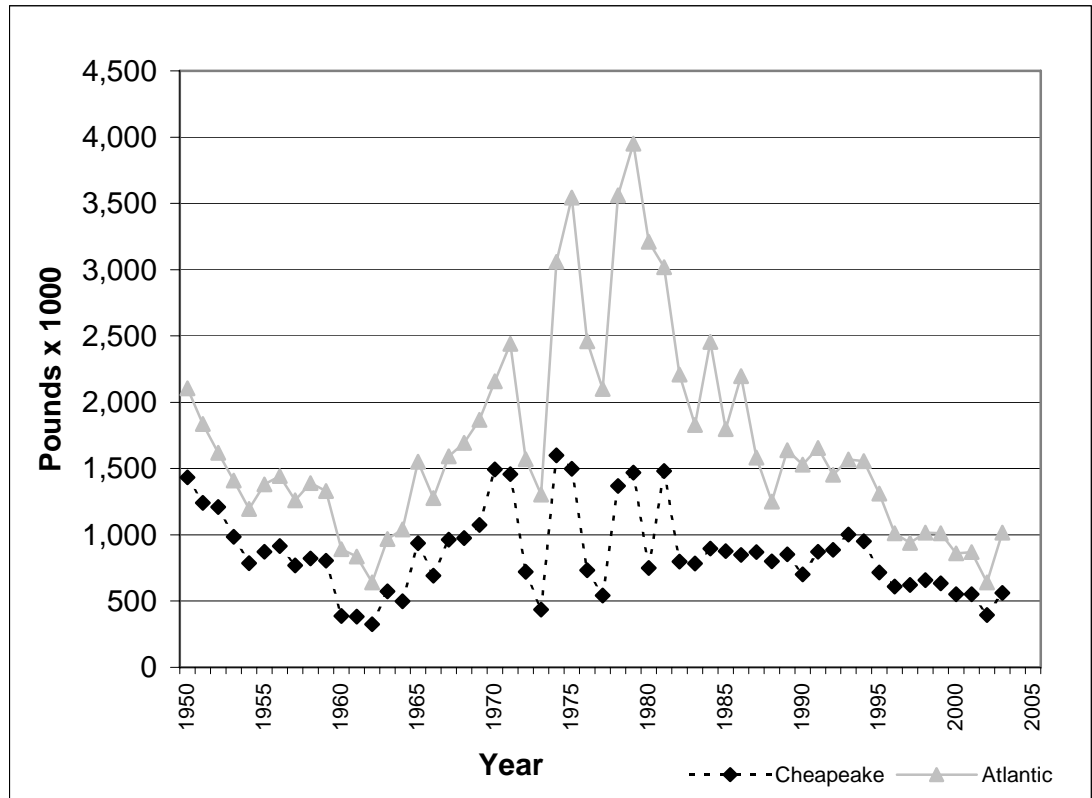
## **Emerging Issues**

There are many research needs regarding American eel. Of primary importance is data for a stock assessment. In 2004, at the ASMFC American Eel Technical Committee meeting, Dr. John Casselman presented current stock status findings by the Canada Department of Fisheries and Oceans (DFO). These data show a decline in commercial landings and a decline in the recruitment of eels ascending the eel ladder at the Moses-Saunders hydroelectric dam that spans the St. Lawrence River (Fig. 2.2). This population typically consists of large, fecund females. When fish stocks decline, the decrease is often first observed at the extremes of the population range, such as the St. Lawrence River. A peer-reviewed stock assessment of American eel by ASMFC is scheduled for completion in 2005. This will be the first coordinated assessment of American eels by ASMFC.

All of these issues led to a November 2004 petition to the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) to list the American eel as an endangered species. It was the beginning of a lengthy process; starting with a 90-day review to determine the legitimacy of the petition, followed by a

twelve-month status review. The USFWS is conducting the status review and is awaiting the results of the ASMFC peer-reviewed stock assessment as part of their investigation. They are also examining threats to the American eel population, including fish passage, and impacts from pesticides, dams and water quality (ASMFC Proceedings 2005). If the American eel is listed as an endangered species, it would result in a moratorium on harvest.

Figure 2.1. Commercial Landings for Atlantic and Chesapeake States, 1950-2003. Data from National Marine Fisheries Service.



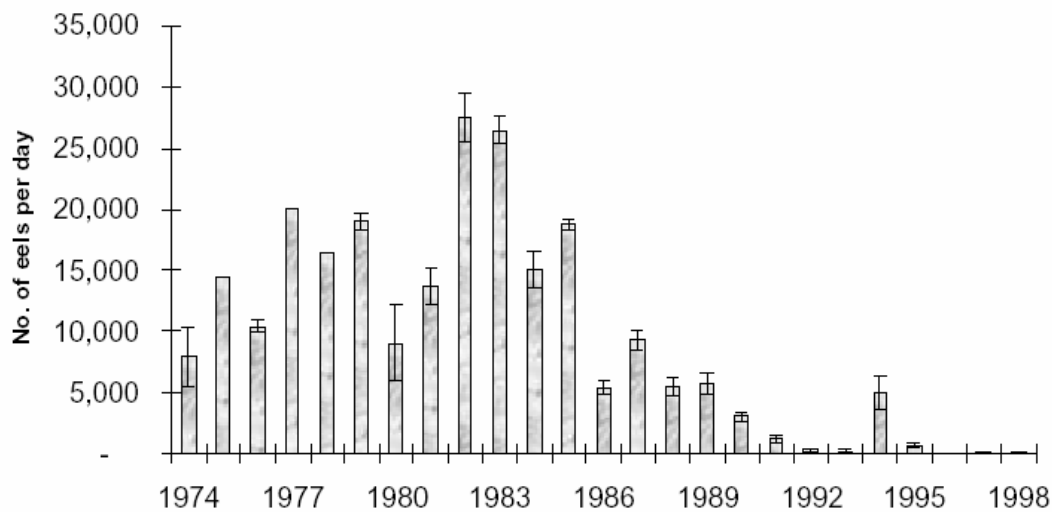


Fig. 2.2. Mean number of eel ascending the eel ladder per day at the Moses-Saunders Hydroelectric Dam at Cornwall, Ontario, during a 31-d peak migration period from 1974-98. Vertical bars indicate the 95% confidence intervals (from Casselman et al. 1997, Mathers et al 1998).

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Table 2.1 Chesapeake Bay American Eel Implementation

Problem Area	Action	Date	Comments
1. Stock Status	1.1 Maryland and PRFC will adopt a 6" minimum size limit. Virginia will continue a prohibition of taking elvers and adjust definition to correspond to a 6" minimum size limit	1992 1993 Continue	The 6" minimum size will prevent the development of an elver fishery. In MD, 1994 regulations were adopted limiting the harvest of eels less than 6" to 25 per day. ASMFC has recommended a 50 eel limit.
	1.2 MD will implement a ½ by ½" mesh size for eel pots. VA & PFRC will continue to enforce their ½ x ½" mesh. VA will continue to enforce ½ by 1" escape panels in ½ x ½ mesh pots	1993 Continue	MD, VA and PFRC currently enforce the 1/2x ½ minimum mesh size for eel pots.
	1.3 Upon restoration of eels to the Susquehanna River basin PFRC will adopt regulations to prevent over fishing of small eels.	On-going	Fish passage goals have been adopted for the Bay and Tributaries
2. Bait Fishery	2.1 MD will require the reporting of eels used for crab bait on crab reporting forms	1993	Information gathered from the Crab Reporting Forms indicated that previous bait estimates were probably too high. Commercial harvest data is continually being improved.
3. Research Needs	3.1 Continue to collect catch & effort data from live eel fishery and begin monitoring crab bait fishery	Continue	Basic stock assessment and biological monitoring is needed. MD conducts an annual population study which was started in 1998 to present.
	3.2 Encourage research to collect basic biological and socioeconomic information	Continue	Since an ASMFC coastal eel FMP was adopted in 2000, states are required to conduct an annual young of year survey (starting in 2001). Emphasis has also been placed on collecting stock assessment data. Eels are under investigation whether to be listed as endangered by USFWS.
4. Habitat and Water Quality Issues	4.1 Continue to provide stream passage	Continue	A new CBP fish passage goal was adopted in 2005.
	4.2 Continue to set specific objectives for water quality goals and habitat requirements.	Continue	The Chesapeake Bay Program has continued to emphasize water quality and habitat commitments. Additional actions were added the C2K including stream health guidelines which will impact eel habitat

ASMFC= Atlantic States Marine Fisheries Commission  
FMP= Fishery Management Plan

C2K= Chesapeake 2000 agreement  
PFRC= Potomac River Fisheries Commission